

PENTAGRAMMA LONGISTYLATA
(HOMOPTERA: DELPHACIDAE):
DESCRIPTIONS OF IMMATURE STAGES

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Abstract.—The egg, 3rd, 4th, and 5th nymphal instars, and male and female genitalia of *Pentagramma longistylata* Penner are described and illustrated and an illustration of the adult habitus is provided. Features useful in separating nymphal instars include differences in body and wingpad sizes, spination of metatibiae and tarsomeres, number of metatarsomeres and body pits. *P. longistylata* was collected on *Scirpus americanus* Pers. (Cyperaceae) in Oklahoma and Texas.

Pentagramma longistylata Penner is a little-studied asiracine delphacid known from Florida and Texas (Penner, 1947). Other than Penner's comment that members of this genus are commonly collected on marsh grass, rushes, and sedges, no host plant records have been published.

Little morphological or ecological information is available on the immatures of the approximately 290 species of North American delphacids. Although immatures of Delphacinae (sensu Muir, 1930) have been described, e.g., *Dephacodes bellicosa* Muir and Giffard by Wilson (1985) and *Megamelus davisii* Van Duzee by Wilson and McPherson (1981a), no species of Asiracinae has been described or illustrated. Information on immature asiracines is of interest because adults bear several plesiomorphic features such as the awl-shaped metatibial spur and the aedeagal flagellum. Furthermore, the Asiracinae do not appear to represent a monophyletic group (Asche and Remane, 1982); morphological features of representative asiracine genera may help resolve the status of this group.

This paper presents descriptions and illustrations of the male and female genitalia, egg, and 3rd, 4th, and 5th instar nymphs of *P. longistylata*, compares the nymphs with those of other North American delphacines, and includes comments on some morphological differences between delphacid nymphs and those of certain other planthopper families.

DESCRIPTIONS

Specimens were preserved in 70% ethyl alcohol. The 5th instar is described in detail but only major differences are described for 4th and 3rd instars. Measurements are given in mm as mean \pm SD. Length was measured from apex of vertex to apex of abdomen, width across the widest part of the body, and thoracic length along the midline from the anterior margin of the pronotum to the posterior margin of the metanotum. Eggs were obtained by dissecting a gravid female.

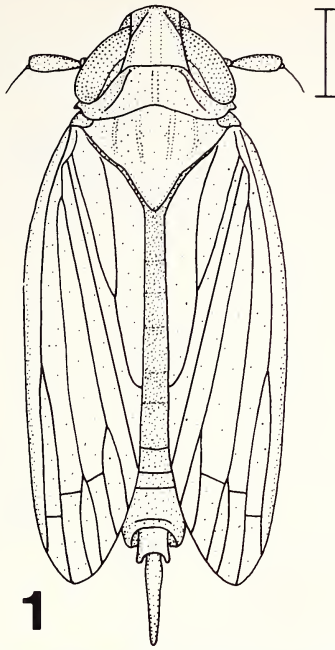


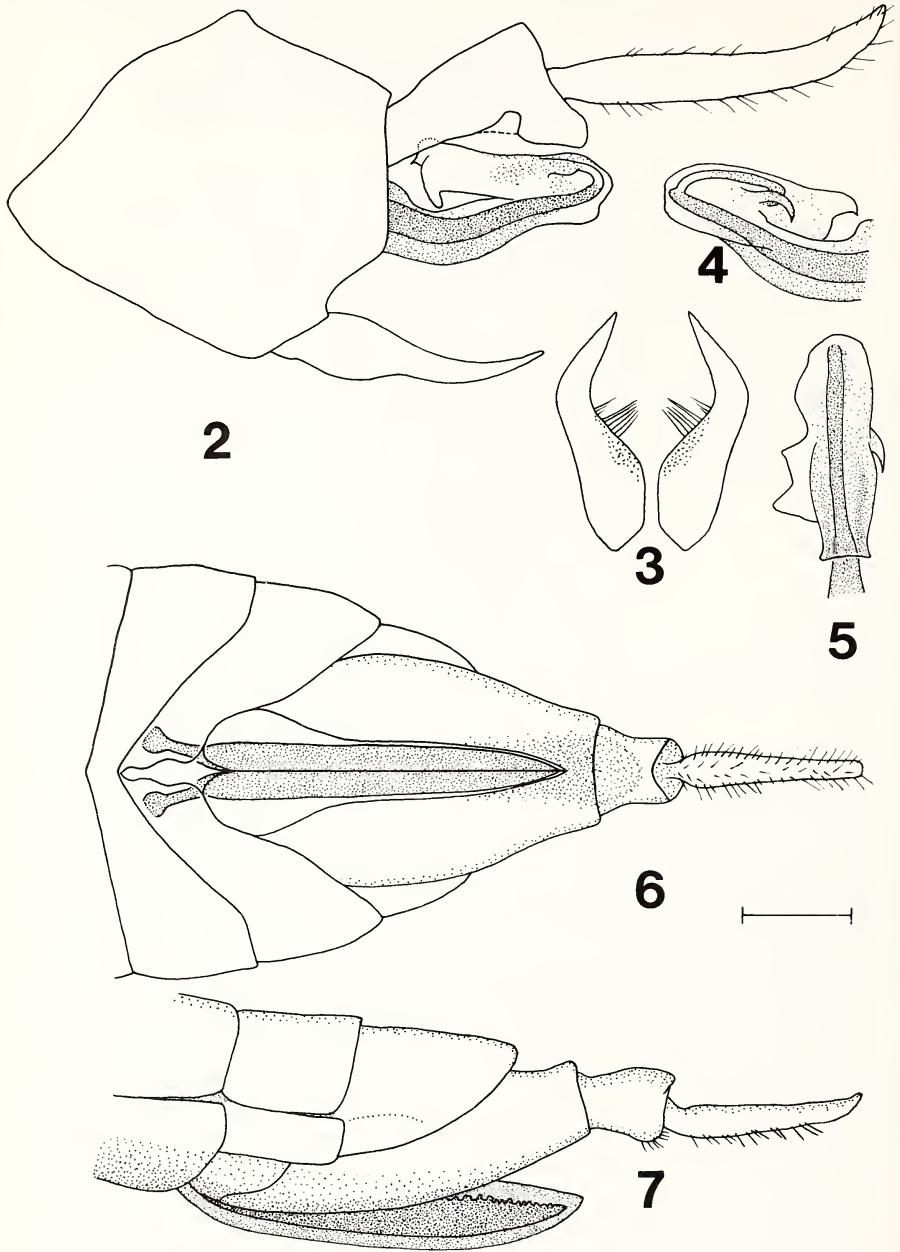
Fig. 1. Habitus of male *Pentagramma longistylata* Penner. Vertical scale = 1.0 mm.

The collecting data for specimens used in the descriptions are: OKLAHOMA: Cleveland Co., S. Canadian River, Norman, Coll. S. Wilson, 3-IX-1978 (2—5th instars, 1♂, 1♀), 29-VIII-1983 (3—3rd, 7—4th, 13—5th, 12♂♂, 9♀♀); TEXAS: Galveston Co., Galveston Isl., 26-IV-1983, Coll. A. G. Wheeler, Jr. (1—3rd, 13—4th, 5—5th, 3♂♂, 3♀♀); all specimens collected on *Scirpus americanus* Pers. (Cyperaceae), commonly known as common three square or American bulrush.

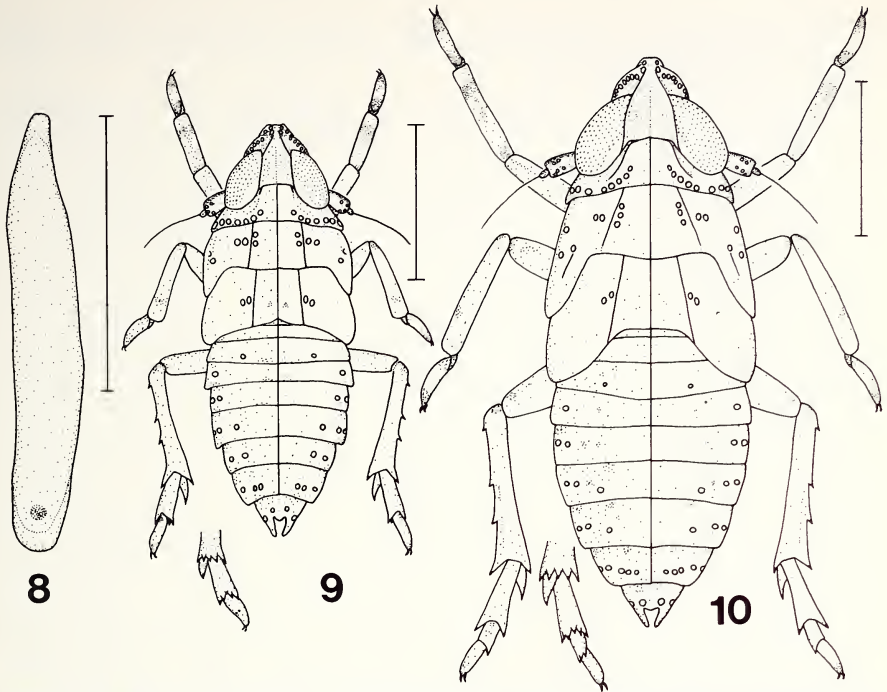
Adult (Figs. 1–7). Penner (1947) provided a detailed description of adult *P. longistylata* and illustrations of the head and pygofer. He did not provide descriptions or illustrations of the details of the male or female genitalia.

Male genitalia (Figs. 2–5). Pygofer cylindrical; caudal edge sinuate in lateral view. Anal tube subcylindrical; in lateral view, with ventral margin produced on either side; anal style elongate, ca. $2 \times$ length of anal tube. Styles caliper-shaped with apices acute, inner margin bearing elongate setae, rugose near middle. Aedeagal complex with basally sclerotized periandrum and apical membranous flagellum folded anteriorly on left side; with internal, heavily sclerotized aedeagus opening distally into slender transparent membranous tube curving anteriorly and opening into flagellum; flagellum bearing a curved, acute process on right side.

Female genitalia (Figs. 6, 7). Segment 9 elongate, subcylindrical with a deep sternal, longitudinal groove for reception of the valvulae. Anal tube cylindrical, length subequal to width; anal style slender, elongate, $2-2\frac{1}{2} \times$ length of anal tube. Valvulae 3 (sawcase) lanceolate, broadest in basal $\frac{1}{3}$. Valvulae 2 lanceolate, convex, and ex-



Figs. 2-7. *P. longistylata* male and female genitalia. 2. Complete left lateral view of male. 3. Styles. 4. Aedeagus, right lateral view. 5. Aedeagus, ventral view. 6. Ventral view of female. 7. Left lateral view of female. Vertical scale = 0.5 mm.



Figs. 8–10. Immature stages of *P. longistylata*. 8. Egg. 9. Third instar. 10. Fourth instar. Vertical scales = 1.0 mm.

tending to apex of valvulae 1. Valvulae 1 thick, fused medially for most of length, lateral edges curved over onto dorsal aspect creating troughlike appearance, ventral aspect with a longitudinal row of well-developed teeth in distal $\frac{2}{3}$.

Fifth instar (Figs. 11–14). Length 4.1 ± 0.34 ; thoracic length 1.3 ± 0.09 ; width 1.5 ± 0.13 ($N = 18$).

Form elongate, subcylindrical, slightly flattened dorsoventrally, widest across mesothoracic wingpads. Body pale green in life (whitish in alcohol) with reddish and white transverse markings on head and fuscous longitudinal stripes on antennae and pro- and mesothoracic legs.

Vertex subtriangular, length subequal to width, lateral margins carinate, extending onto frons as inner carinae. Frons green with 2 orange transverse bands, 1 in upper $\frac{1}{3}$, the other in lower $\frac{1}{2}$, separated by transverse white band extending onto genae, a white band at frontoclypeal juncture; ovoid, slightly longer than wide; lateral margins carinate (outer carinae), extending from juncture of vertex to clypeal border and parallel pair of inner carinae; 11 pits between each outer and inner carina, 7–8 pits between each outer carina and eye. Clypeus narrowing distally, consisting of subconical basal postclypeus and cylindrical distal anteclypeus. Beak 3-segmented, segment 1 obscured by anteclypeus, segment 2 $1\frac{1}{2} \times$ length of segment 3. Eyes red with white stripes. Antennae 3-segmented, scape and pedicel subcylindrical, with a pair

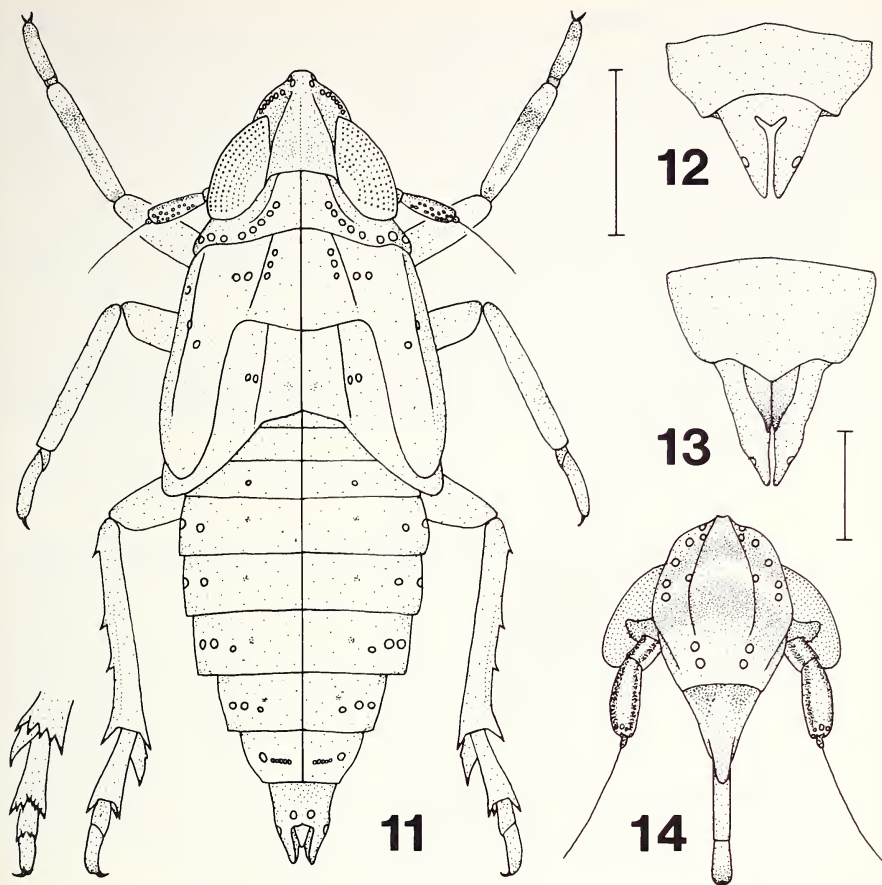
of longitudinal brown stripes on anterior aspect; pedicel ca. $2 \times$ length of scape, with more than 25 pitlike sensoria; flagellum bulbous basally, filamentous distally, basal portion ca. $\frac{1}{5}$ length of pedicel.

Thoracic nota divided by middorsal line into 3 pairs of plates. Pronotum with each plate subrectangular, anterior margin following curvature of posterior border of eye, posterior margin slightly sinuate; each plate with a lateral carina in median $\frac{1}{3}$ of pronotum extending from anterior margin posterolaterally curving outwards and disappearing in posterior $\frac{1}{3}$ of plate, carina bordered along inner margin by a row of 12 pits extending posterolaterally to lateral border of plate (lateralmost pits not visible in dorsal view). Mesonotum with median length ca. $1.3 \times$ that of pronotum; each plate bearing an elongate, lobate wingpad extending to near apex of metanotal wingpad; with longitudinal carina originating in median $\frac{1}{3}$ and extending posterolaterally to near posterior border of plate; with a row of 3 pits along inner margin of carina and 2 pits between carina and lateral margin of plate; with an outer partial longitudinal carina in lateral $\frac{1}{4}$ originating near anterior border of plate and disappearing on wingpad; with 3 pits near outer carina. Metanotum with median length subequal to mesonotum; each plate with weak longitudinal carina in median $\frac{1}{3}$; wingpad lobate, extending just beyond juncture of 3rd and 4th abdominal tergites; with 2 pits lateral to carina. Pro- and mesocoxae elongate, posteromedially directed; procoxae with dark markings on ventral aspect, metacoxae fused to metasternum. Metatrochanters globose with minute teeth on medial margins. Pro- and mesofemora with longitudinal brown stripes; metafemora with a partial longitudinal brown stripe. Protibiae with longitudinal brown stripes and a transverse brown stripe in distal $\frac{1}{2}$. Metatibiae with 3 black-tipped teeth on lateral aspect of shaft and an apical transverse row of 5 black-tipped spines on ventral aspect, with a conical, moveable black-tipped spur $2 \times$ or more length of longest tibial spine. Pro- and mesotarsi each with 2 tarsomeres; tarsomere 1 wedge-shaped, tarsomere 2 elongate, subcylindrical and curved; tarsomeres of prothoracic legs with dark brown transverse stripes or entirely dark brown, mesothoracic tarsomeres similar but lighter; metatarsi with 3 tarsomeres, tarsomere 1 with an apical transverse row of 8 black-tipped spines on ventral aspect, tarsomere 2 ca. $\frac{1}{2} \times$ length of 1, with an apical transverse row of 4 black-tipped spines on ventral aspect, tarsomere 3 similar but shorter than terminal tarsomeres of other legs; all tarsomeres bearing a pair of brown, curved apical claws and a median membranous pulvillus.

Abdomen 9-segmented, slightly flattened dorsoventrally, widest across segment 4. Tergite 1 very small, tergites 2–9 each with a weak median longitudinal carina; 3–8 each with the following number of pits on either side of midline (lateralmost pits not visible in dorsal view due to curving of tergites onto ventral aspect): 3 with 1, 4 with 2, 5 with 3, 6 with 5, 7 with 5, 8 with 8. Segment 9 cylindrical, with 3 pits on either side of midline; females with 1 pair of acute processes extending from juncture of sternites 8 and 9; males lacking processes.

Fourth instar (Fig. 10). Length 2.8 ± 0.29 ; thoracic length 0.9 ± 0.03 ; width 1.0 ± 0.05 ($N = 20$).

Vertex slightly longer than wide. Frons with width $\frac{3}{4} \times$ length; 11–12 pits between each inner and outer carina and 6–8 pits between each outer carina and eye. Antennal flagellum with bulbous portion ca. $\frac{1}{5}$ length of pedicel; ca. 13 pitlike sensoria on pedicel.



Figs. 11-14. *P. longistylata* fifth instar. 11. Nymph. 12. Male, ventral view of apex of abdomen. 13. Female, ventral view of apex of abdomen. 14. Head, frontal view. Vertical scales = 1.0 mm (11); 0.5 mm (12-14).

Pronotum with 10-11 pits on each plate. Mesonotal wingpads shorter, covering ca. $\frac{1}{2}$ of metanotal wingpads laterally. Metanotum with median length slightly longer than that of mesonotum; wingpads extending to tergite 3. Metatarsi with tarsomere 1 bearing 7 apical black-tipped spines on ventral aspect; tarsomere 2 with an apical row of 3-4 black-tipped spines on ventral aspect, middle spines very weak.

Abdominal tergites with the following pits on either side of midline: tergite 3 with 1, 4 with 2, 5 with 4-5, 6 with 4-6, 7 with 6-7, 8 with 8-10. Segment 9 with 3 pits on either side of midline. Females with lobate processes at juncture of sternites 8 and 9 very small.

Third instar (Fig. 9). Length 2.0 ± 0.09 ; thoracic length 0.7 ± 0.04 ; width 0.7 ± 0.06 (N = 4).

Vertex with length ca. $1\frac{1}{2} \times$ width. Frons with 10-11 pits between each inner and

outer carina and 6 pits between each outer carina and eye. Antenna with pedicel bearing ca. 5 pits.

Pronotum with 9 pits on each plate. Mesonotal wingpads shorter, covering ca. $\frac{1}{3}$ of metanotal wingpads laterally. Metatarsi with 2 tarsomeres, tarsomere 1 with an apical transverse row of 5 black-tipped spines; tarsomere 2 similar to terminal tarsomeres of later instars, occasionally with 1–2 very tiny black-tipped teeth on ventral aspect near middle.

Abdominal tergites with the following number of pits on either side of midline: 3 with 1, 4 with 2, 5 with 4, 6 with 5, 7 with 5, 8 with 6. Segment 9 with 3 pits on either side of midline. Lobate processes originating from sternite 8 of female apparently lacking.

Egg (Fig. 8). Length 1.2 ± 0.03 ; width 0.2 ± 0.02 (N = 10).

Elongate, cylindrical, slightly sinuately curved; narrowing at ends; anterior end somewhat truncate, posterior end broadly rounded. Chorion translucent, with very small shallow pits (not illustrated), white.

NOTES ON MORPHOLOGY

Pentagramma nymphs differ from those of delphacines examined (e.g., *M. davisi*, *D. bellicosa*) in the larger number of antennal sensoria present in each nymphal instar, the presence of dorsal median longitudinal carinae on the abdominal tergites, and in the number of metatarsomeres in the 4th instar. In 4th instar nymphs of acanaloniid, cixiid, flatid, issid, and tropiduchid planthoppers there are 3 well-defined metatarsomeres (Wilson and McPherson, 1981b–d; Wilson and Tsai, 1982; Wilson et al., 1983; Wilson and Wheeler, 1984). Fourth instar delphacines have a partial subdivision of the terminal (2nd) metatarsomere with 2 weakly developed teeth on the ventral aspect (Metcalfe, 1969; Wilson and McPherson, 1981a; Wilson, 1985). The 3 well-defined tarsomeres with 3–4 terminal teeth represent a plesiomorphic condition within the Delphacidae. This condition also has been found in 4th instars of Old World asiracines (Asche, Hoch, and Remane, pers. comm.).

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